SUMMARY OF PRESENT INVENTION

Typically, circuits for determining signal power must calculate the squared terms for both the real and imaginary parts of a complex signal. However, the multipliers required to calculate the square terms require relatively large amounts of area.

The present invention teaches a power approximation circuit that uses less area than prior art by eliminating the need to calculate the squared terms, thus eliminating the need for multipliers. Instead, the absolute value of the real and imaginary parts of a signal are calculated and added together. Then an expectation function is applied to the sum. The resulting value is a close approximation of the actual power of the signal.

REMARKS

Claims 17-21 remain in the application.

Claim rejections - 35 U.S.C. §102(b)

Claims 17-20 were rejected under 35 U.S.C. §102(b) as being anticipated by USPN 5,657,354 to Thesling.

Thesling

Thesling's invention is the log-likelihood ratio planar approximation (LLRPA). The LLRPA is simply an approximation of the log-likelihood ratio (LLR), which is expressed by the following equation:

$$LLR\,(I,Q) = \ln\left[\frac{\sum_{i=0,even}^{7} e^{-(E_S/N_0)d_i^2}}{\sum_{i=0,odd}^{7} e^{-(E_S/N_0)d_i^2}}\right]$$

The LLR is a statistical signal metric that expresses the likelihood that certain values will appear in the signal. The LLR is difficult and complicated to compute. Therefore, Thesling invented an approximation of the LLR, called the LLRPA, which is much simpler to calculate than the LLR. The LLRPA is not an approximation of the power of the signal.

Thesling teaches that the LLRPA is calculated using the following equation:

$$LLRPA(I,Q) = \max\begin{Bmatrix} 29\times abs(I) - 70\times abs(Q) \\ 29\times abs(Q) - 70\times abs(I) \end{Bmatrix}$$

The absolute values of I and Q are calculated, then multiplied by a scalar, and then subtracted from one another.

The present invention

In distinct contrast to Thesling, the present invention teaches a power approximation circuit that avoids calculating squared terms by using an expectation function. First, the power approximation circuit calculates the sum $|I|+|Q|$ (Page 17, lines 11-22). Then, an expectation function is applied to that sum to produce an approximation for the power of the complex signal. The expectation function is an averaging function, which in one embodiment follows the equation:

$$\sqrt{\tilde{N}_i} = a(|I|+|Q|)+(1-a)\sqrt{\tilde{N}_{i-1}}$$

where a is an averaging constant between 0 and 1 (page 18, line 1).

Novelty of the present invention

Thesling does not teach calculating an approximation for the power of a signal. Thesling's invention, the LLRPA, is simply a statistical approximation of the likelihood that certain values will appear in the signal. In distinct contrast, the present invention does teach power approximation as recited in claim 17: "the power approximation circuit generating an approximate power value which indicates an actual power value for the complex signal".

Furthermore, Thesling does not teach an expectation function. Thesling does teach combining absolute values of I & Q, but does not apply any expectation or averaging function to the combined values. In distinct contrast to the prior art, the present invention teaches applying an expectation function, as recited in claim 17: "and then applying an expectation function to the combined absolute values".

Claim 17 is believed to be allowable, based on the patentable features recited within. The rejection to claim 17 is believed to be overcome.

Dependent claims 18-21 are believed to be allowable based on the allowability of claim 17. The rejections to claims 18-20 and the objection to claim 21 are believed to be overcome.

CONCLUSION

If the Examiner has any further questions or would like to discuss this application in more detail, he is invited to call the Applicants' agent at the telephone number given below. The Applicants respectfully suggest that the claims presently in the application are distinct over the prior art and that the application is now in condition for allowance. Accordingly, the Applicants solicit favorable action.

Respectfully submitted,
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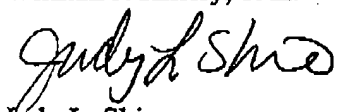

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